BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
II Semester 2021-2022
Course: CE F429 DESIGN OF FOUNDATION SYSTEM
Mid-Sem Test (OPEN BOOK)

Duration:90 min. Dated: 11-03-2022 Max. Marks: 30

Answer Part A and B in separate answer sheets.
You are allowed to do Part B (open book) after submitting Part A answer sheets.

Part A (Closed Book)

Q1. List various field tests for design of foundation. Mention various soil types for which these are most suitable and unsuitable in tabular form. **[3 marks]**

Q2. What is the importance of strain for dynamic properties of soil such as shear modulus and damping in context of machine foundations and seismic analysis of foundations? Draw neat figures and explain. Shear modulus obtained by SPT correlation correspond to high strain or low strain, explain. What are the different types of Damping in soils? Explain? **[3 marks]**

PART B (OPEN BOOK)

Note: You are allowed to do Part B (open book) after submitting Part A answer sheets.

Q3. It is proposed to build a power plant near Yamuna river in Delhi (Mw=7). The construction site contains sandy soil. The soil deposit is fully saturated with γ_{sat} =18 kN/m^{3}and Water table may be assumed at a depth of 2 m from ground level. Use IS1893-part1-2016 (Youd et al. 2001), procedures to find factor of safety against liquefaction at 5 m from ground level using CPT data. At the depth of 5 m, the penetration resistances at the cone tip and the sleeve were measured to be 3.5 MPa and 15 kPa, respectively. Using CPT data at 5 m depth find relative density of sandy soil. Find approximate percentage of fines also in the soil. **[7 marks]**

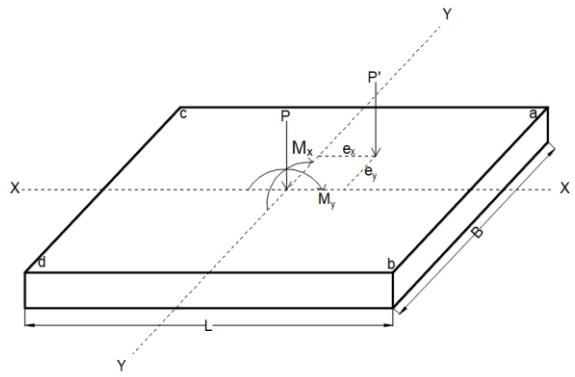
Q4. Find the safe thickness of the isolated square footing by one-way shear (assume 0.5% steel), two-way shear and flexure for the column (size 400 mm x 400 mm) subjected to a factored axial force of Vu = 1600 kN and factored moment of Mu = 350 kNm due to earthquake. Assuming 3 m length and 3.0 m width of foundation is worked out safe and the center of column coincides with the center of footing. Take M 25 grade concrete and 20 mm bars of Fe 500 grade steel for both footing and column. **[8 marks]**

Q5. A spread footing with a dimension of 2.25 m × 2.25 m is embedded in sandy soil at a depth of 2.0 m is subjected to a net foundation pressure of 113 kPa. A CPT is done for the site and the results are shown below.

Depth from ground level (m)	0-2	2-3	3-4	4-5	5-7	7-9
Average CPT resistance q_c(MPa)	1.5	2.4	3.2	4.1	6.5	8.5

The groundwater table is at a depth of 1.8m and the unit weights of the sand are 17.5 and 18.1 kN/m^3 above and below the groundwater table, respectively. Compute the settlement of the footing right after construction using the Schmertmann (1978) method. **[7 marks]**

Q6. A rectangular footing 2.5 x 3.5 m (designed for the column whose center coincides with the center of footing) is subjected to biaxial moments of My=600 kN-m (about an axis parallel to 2.5 m side and axis is passing through CG of footing) and Mx = 400 kN-m (about an axis parallel to 3.5 m side and axis is passing through CG of footing) as well as vertical load of 1000 kN. Draw the properly dimensioned plan of the foundation (with suitable depiction of zero pressure line) and pressure distribution. **[6 marks]**



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